



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

5 W

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/909,847	07/20/2001	Alain Izadnegahdar	015559-250	8794

27805 7590 02/27/2004
THOMPSON HINE L.L.P.
2000 COURTHOUSE PLAZA, N.E.
10 WEST SECOND STREET
DAYTON, OH 45402

EXAMINER

TUGBANG, ANTHONY D

ART UNIT PAPER NUMBER.

3729

DATE MAILED: 02/27/2004

10

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/909,847

Applicant(s)

IZADNEGAHDAR ET AL.

Examiner

A. Dexter Tugbang

Art Unit

3729

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-46, 52-60 and 62-67 is/are pending in the application.
- 4a) Of the above claim(s) 3-5, 8, 9, 12-23, 25-46, 52-60 and 64-67 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 6, 7, 10, 11, 24, 62 and 63 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 4,7.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

1. Upon further consideration by the examiner, the previous restriction requirement (Paper No. 6) has been withdrawn in view of the following.
2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-27 and 62-63, drawn to a process of making a sensor, classified in class 29, subclass 25.35.
 - II. Claims 28-46, 52-60 and 64-67, drawn to a produce of a pressure sensor, classified in class 73, subclass 753.

The inventions are distinct, each from the other because of the following reasons:

3. Inventions of Groups I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product of Group I can be made by a materially different method, such as one that forms the sensor with mere coating or deposition techniques without reducing thicknesses of any materials, without any etching, or without any fusion bonding.
4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.
5. If applicant(s) elect the invention of Group I, a further restriction to one of the following inventions is required under 35 U.S.C. 121:

Art Unit: 3729

- I-A. Claims 2, 6, 7, 10, 11, 24, 62 and 63, drawn to a process of reducing a thickness of a diaphragm wafer, classified in class 29, subclass 25.35.
- I-B. Claims 4, 5, 19-23, 25, and 26, drawn to a process of reducing a thickness of a base wafer, classified in class 29, subclass 594.
- I-C. Claims 3, 27, drawn to a process of fusion silicon bonding, classified in class 29, subclass 840.
- I-D. Claims 8, 9, drawn to a process of depositing conductive leads, classified in class 29, subclass 846.
- I-E. Claims 12-18, drawn to a process of etching a dicing lane around a sensor, classified in class 29, subclass 412.

The inventions are distinct, each from the other because of the following reasons:

6. Inventions of Groups I-A through I-E are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, for example, the invention of Group I-A has separate utility within the process of making, such as reducing a thickness of a diaphragm wafer, not required by any of the other Groups. See MPEP § 806.05(d).
7. Claim 1 link(s) the inventions of Groups I-A through I-E. The restriction requirement between the linked inventions is subject to the nonallowance of the linking claim(s), claim 1. Upon the allowance of the linking claim(s), the restriction requirement as to the linked inventions shall be withdrawn and any claim(s) depending from or otherwise including all the limitations of the allowable linking claim(s) will be entitled to examination in the instant application. Applicant(s) are advised that if any such claim(s) depending from or including all

Art Unit: 3729

the limitations of the allowable linking claim(s) is/are presented in a continuation or divisional application, the claims of the continuation or divisional application may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Where a restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. *In re Ziegler*, 44 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

8. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

9. During a telephone conversation with Steven J. Elleman, on February 19, 2004, a provisional election was made without traverse to prosecute the invention of Group I-A, Claims 2, 6, 7, 10, 11 and 24. Affirmation of this election must be made by applicant in replying to this Office action. Claims 3-5, 8, 9, 12-46, 52-60 and 64-67 have been withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

10. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Specification

11. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: A Method of Manufacturing a Thin Resistive Pressure Sensor.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 1, 2, 6, 7 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by the IEEE Publication to Chung et al, entitled “Novel High-Performance Pressure Sensors using Doubling SOI Structures”.

Chung discloses a method for forming a pressure sensor (shown in Figure 2) comprising: providing a base wafer (step 1); forming a sensor cavity in the base wafer (step 6); coupling a diaphragm wafer to the base wafer (silicon layer in steps 5 and 6), the diaphragm wafer including a diaphragm portion, a sacrificial portion (Si layer), and an insulating layer (Al_2O_3 layer) disposed between the diaphragm portion and the sacrificial portion (step 6); reducing the thickness of the diaphragm wafer by removing part of the sacrificial portion (Si layer portion in step 7) while using the insulating layer (Al_2O_3 layer) as an etch stop (see page 679); and forming or locating at least one piezo resistive portion on the diaphragm portion (step 9).

Art Unit: 3729

Regarding Claim(s) 2, Chung further teaches that the diaphragm wafer is a silicon-on-insulator, or SOI, wafer including upper and lower silicon wafers (see step 5) separated by the insulating layer where the upper silicon wafer includes the sacrificial portion and the lower silicon layer includes the diaphragm portion. The reducing step includes removing substantially all of the upper silicon layer of the diaphragm wafer located over the sensor cavity (see step 7).

Regarding Claim(s) 6, Chung further teaches that the base wafer and the diaphragm wafer are both SOI wafers (see page 678).

Regarding Claim(s) 7, Chung further shows that the forming or locating step includes bombarding a portion of the diaphragm wafer with high energy atoms of SiO_2 (in step 8) using implantation methods of deposition for electrode formation (as shown in step 9).

Regarding Claim(s) 24, Chung teaches (in step 9) that the sensor cavity is sealed between the diaphragm portion and the base wafer by an insulating layer (Al_2O_3 layer).

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al.

The condition of having the sensor cavity “generally circular” in shape is considered to be a parameter of an effective variable within the level of ordinary skill in the art of manufacturing pressure sensors. It would have been obvious to one of ordinary skill in the art at

Art Unit: 3729

the time the invention was made to have formed the shape of the sensor cavity of Chung as “generally circular” in shape, since the shape is considered to be an effective variable to achieve a desired result through routine experimentation. *In re Aller*, 220, F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

16. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al in view of Klima 4,530,734.

Chung discloses the claimed manufacturing method as relied upon above. Chung does not appear to mention that the sensor cavity is formed by deep reactive ion etching.

Klima suggests that cavities formed in wafer materials (shown in Fig. 3) can be accomplished by deep reactive ion etching for the advantages of achieving particular dimensions, i.e. depth and width, of the cavity (see col. 5, lines 3+).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Chung by forming the sensor cavity using deep reactive ion etching, as taught by Klima, for the advantages of achieving certain dimensions of the cavity.

17. Claims 62 and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over the IEEE Publication to Petersen, entitled “Surface Micromachined Structures Fabricated with Silicon Fusion Bonding”, in view of Klima.

Petersen discloses a method of forming a sensor comprising: providing a base wafer (wafer 1 in Fig. 1); forming a sensor cavity in the base wafer (step A of Fig. 1); coupling a diaphragm wafer (wafer 2) to the base wafer; reducing the thickness of the diaphragm wafer (see

Art Unit: 3729

sequence of step A and step B of Fig. 1); and forming or locating a piezo resistive portion (resistor) on the diaphragm wafer.

Petersen does not mention that the sensor cavity is formed by using reactive ion etching, or deep reactive ion etching.

Klima suggests that cavities formed in wafer materials (shown in Fig. 3) can be accomplished by deep reactive ion etching for the advantages of achieving particular dimensions, i.e. depth and width, of the cavity (see col. 5, lines 3+).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Petersen by forming the sensor cavity using deep reactive ion etching, as taught by Klima, for the advantages of achieving certain dimensions of the cavity.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to A. Dexter Tugbang whose telephone number is 703-308-7599.

The examiner can normally be reached on Monday - Friday 7:00 am - 3:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Vo can be reached on 703-308-1789. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 3729

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



A. Dexter Tugbang
Primary Examiner
Art Unit 3729

February 20, 2004